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A middle Eocene Goniopteris

EDWARD W. BERRY

(WITH PLATE 22)

The following new species, based upon rather extensive and well preserved material from the middle Eocene of our southern states, seems worthy of special notice. It is referred to the polypodiaceous genus *Goniopteris* Presl, as amended, and it is hoped that the present note will have some influence with students of living ferns in hastening the much to be desired segregation of the unwieldy and more or less unnatural genus *Dryopteris*, in which *Goniopteris* is often included.

Goniopteris claiborniana sp. nov.

Fronds of large size, probably bipinnate, with a stout prominently winged rachis. Pinnae alternate to subopposite, often prevailingly subopposite. Pinnae shortly stipitate, of large size, linear-lanceolate in outline, averaging between 10 cm. and 15 cm. in length by 1.5–3.5 cm. in maximum width, tapering to an extended, attenuated, acuminate tip. Pinnae variable, normally not entirely segregated into individual pinnules but pinnatifid, the margins being separated into dentate, inequilateral segments with upwardly directed points and narrow, inequilateral sinuses extending one fourth to one third of the distance to the stipe. Pinnae sometimes but slightly pinnatifid with short, conical segments, the sinuses extending only one seventh of the distance to the stipe; sometimes deeply pinnatifid, the sinuses extending about half way to the stipe. Basal proximal pinnule often free and entire.

The three types of marginal lobulation are correlated with three types of venation, although naturally the three are connected by every intermediate gradation. These types will be described after describing what I have called the normal type. This is the type that agrees in its more important particulars with that type familiar in Tertiary ferns and referred by paleobotanists to the more or less interrelated and synonymous genera *Lastrea*, *Phegopteris* and *Goniopteris*. It is a type met with in modern, mostly tropical, ferns, variously segregated or aggregated by students of existing ferns in the genera *Lastrea*, *Nephrodium*, *Phegopteris*, *Polybotrya* and *Dryopteris*.

Christensen, perhaps the foremost living fern student, enumerates upwards of one thousand existing species which he refers to *Dryopteris*. These are segregated into ten groups termed subgenera, although most of them are admittedly of generic rank. These groups of species are named *Eudryopteris*, *Stigmatopteris*, *Ctenitis*, *Lastrea* Bory (emended), *Glaphyropteris* Presl, *Steiropteris*, *Cyclosorus* Link (emended), *Leptogramma* J. Sm., *Goniopteris* Presl (emended), and *Meniscium* (Schreber).

The fossil species here described belongs to this author's ninth subgenus, the emended *Goniopteris* of Presl, which I am recognizing as a valid genus, since the data which paleobotany furnishes to recent botany are obscured by the use of generic names that denote composite aggregations of living species like so many of the fern genera in Die Natürlichen Pflanzenfamilien. *Goniopteris* as delimited by Christensen* has about three score, mainly American tropical species, although it is represented in the Old World by at least two species of Africa, Asia and Australia. It is an eminently natural group that has evidently inhabited southeastern North America since the middle Eocene.

The present type belongs with those fossil forms characterized by a single well marked lateral running to the tip of each lateral lobule and these laterals are more often opposite or subopposite than alternate. Each lateral diverges from the midrib of the pinna at an angle of about sixty degrees and gives off, alternately proximad and distad, simple branches, averaging about eight to ten to a side. The basal distal tertiary of one lateral unites with the basal proximal tertiary of the adjacent superior lateral somewhat above the median point between the two laterals. This united vein, termed a ray by Ettingshausen, proceeds in a flexuous course to the marginal sinus, uniting alternately with the distal and proximal tertiaries from the adjacent laterals. In the marginal lobe there are several simple and free tertiaries, usually three or four running to the distal margin and four to six running to the longer because more arched proximal margin. This type of venation is the prevailing type in the specimens collected and is shown in FIG. 3.

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* Christensen, Carl. On a natural classification of the species of *Dryopteris*. Biologiske Arbeijder Tilegnede Eug. Warming, 73–85. N 1911.

The pinnae with the reduced marginal lobulation have an essentially similar venation to that just described. The laterals are more nearly at right angles with the midrib and the tertiaries number ten or eleven, alternating, rather straight pairs; those from adjacent laterals uniting midway between to form a ray that is rather straighter than in the previous case. Each ray terminates at a sinus and there are usually three pairs of free simple veinlets in each lobule, although two or four pairs may be present at times.

In the pinnae that are deeply pinnatifid, the venation, while of the same general plan as in the preceding cases, varies in certain rather remarkable particulars which serve to distinguish the present form from all other previously described fossil species. Only one, two or three tertiaries from each adjacent lateral are concerned in the formation of a principal ray that runs to the sinus of the margin, and one or the other of these tertiaries may fork, the branch uniting with a branch from the next tertiary, the resultant subsidiary vein or ray uniting with the principal ray near the sinus, the two enclosing a laterally elongated rhomboidal areola. The free veinlets are only from one to three terminal pairs; all of the other tertiaries are at least once forked at a greater or less distance above their base, each limb of the fork uniting with a corresponding fork of the next adjacent tertiary, the resulting ray running directly to the margin. This is the *Goniopteris-Aspidii* type of venation of Ettingshausen's Farnkräuter der Jetzwelt (1865).

The venation of this type is still farther complicated by the frequent presence of a very fine subsidiary branch from one or the other forks of a tertiary, and this fine branch runs directly to the margin. This type of venation is shown in FIG. 4.

The principal intermediate type is one in which only a few of the forks of the tertiaries unite with their adjacent fellows from the adjacent tertiaries to form a ray, the majority of the tertiaries being simply once forked with both branches of such forks terminating in the margin.

This handsome and characteristic species is common in the clays of the Yegua formation at Columbia, Louisiana, occurring also in the sandy clays of the Lisbon formation near Newton, Mississippi, but none of the collected material is in fruit. The form and venation are so well marked and distinctive, however, that the species is at once correlated with the rather abundant Tertiary type that, under the name of *Goniopteris*, *Lastrea* or *Phegopteris*, is so characteristic of the fern floras of that time. It is at once distinguished from all of these by the peculiar venation, otherwise it shows the same habit, winged rachis and outline as, for example, *Lastrea stiriaca* Heer* of the European Oligocene, described originally by Unger† as *Polypodites*, referred to *Goniopteris* by Alexander Braun‡ and to *Phegopteris* by Ettingshausen.§

There are at least fifteen known Tertiary species of this general type, most of which are European, although several have been recorded from American localities. Most of the foreign material is somewhat younger than the present species, although two different forms have been described from the middle Bagshot beds of southern England, a nearly homotaxial (Lutetian) horizon.

Several early Eocene species have been recorded in this country from the Rocky Mountain region. In addition to the differences in venation previously referred to, *Lastrea intermedia* Lesquereux|| from the Denver formation has the pinnae decurrent on the main stipe; *Lastrea Goldiana* Lesquereux¶ from the same horizon has crenulate and deeply divided margins and simple tertiaries; the form from Sand Creek, Colorado, referred to Ettingshausen's Monte Promina species *Lastrea polypodioides***, has a denticulate margin and simple tertiaries. The form from the lower Eocene of Oregon identified by Newberry as *Lastrea Knightiana*†† and commonly referred to the European early Miocene species *Lastrea Fischeri* Heer‡‡ is much like the present species in size and general

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* Heer, Fl. Tert. Helv. **1**: 31. *pl. 7, 8.* 1855; **3**: 151. *pl. 143.* 1859.

† Unger, Chlor. Protog. 121. *pl. 36.* 1847.

‡ Braun, Zeits. Deutsch. Geol. Gesell. **4**: 556. 1852.

§ Ettingshausen, Foss. Fl. Bilin. **1**: 16. *pl. 2, f. 16–18.* 1866.

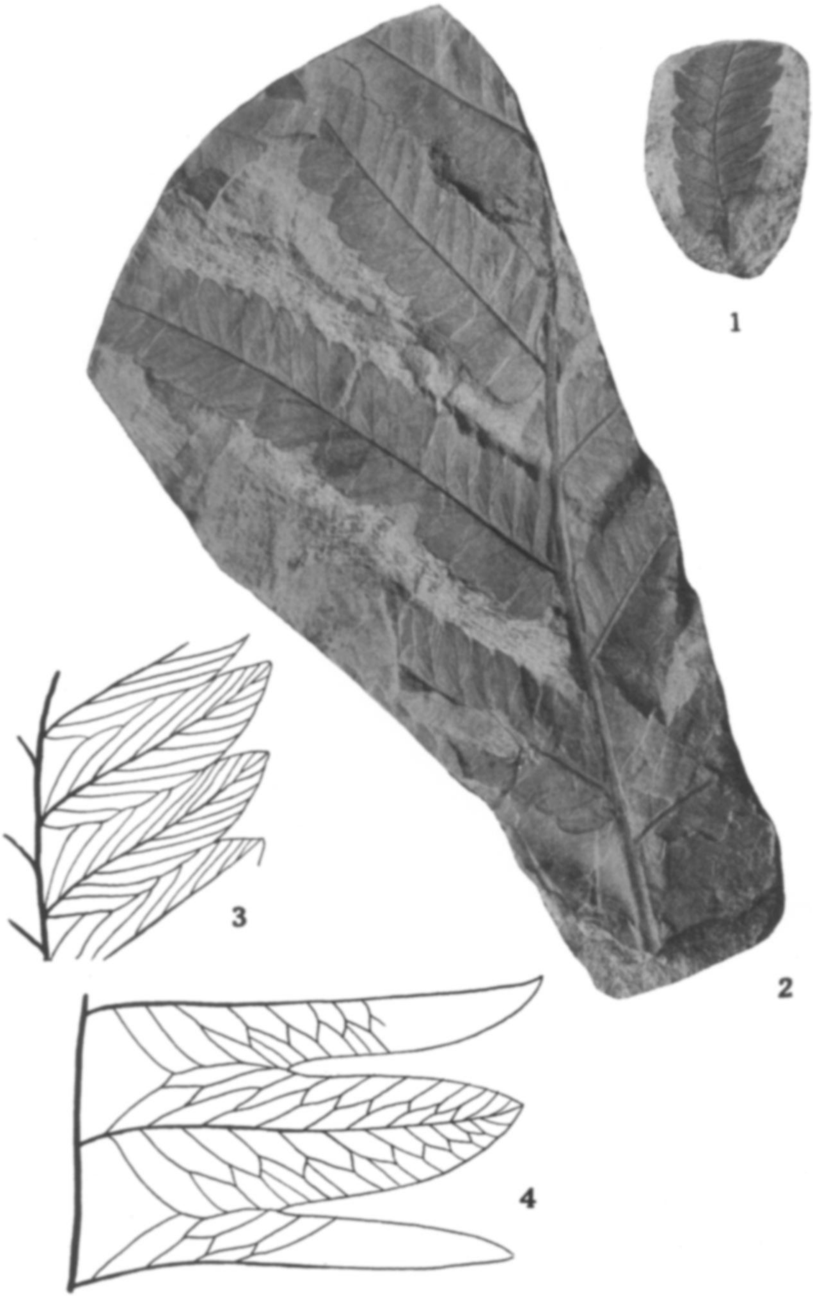
|| Lesquereux, Tertiary Flora, 56. *pl. 4, f. 14.* 1878.

¶ Idem, *f. 13.*

** Idem, 57. *pl. 4, f. 11, 12.*

†† Newberry, Proc. U. S. Nat. Mus. **5**: 503. 1882.

‡‡ Heer, Fl. Tert. Helv. **1**: 34. *pl. 9, f. 3.* 1855; Lesquereux, Cret. & Tert. Fl. 239. *pl. 50, f. 1, 1a.* 1883; Newberry, Mon. U. S. Geol. Surv. **35**: 10. *pl. 48, f. 6.* 1898.



GONIOPTERIS CLAIBORNIANA BERRY

appearance, but differs in venation. The American material of this last species is rather poor and I doubt very much its identity with the European type. A very widespread Tertiary type of fern liable to be confused with the *Goniopteris* is *Osmunda lignitum* Stur* in which, however, the tertiaries are all always simple, neither anastomosing nor forming interlateral rays.

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Explanation of plate 22

GONIOPTERIS CLAIBORNIANA Berry

From the Eocene of Columbia, Louisiana.

FIG. 1. Portion of a pinna, natural size.
FIG. 2. Fragment of a frond, natural size.
FIG. 3. Normal type of venation, × 4.
FIG. 4. Unusual type of venation, × 4.

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* Stur, Jahrb. k. k. Geol. Reichs. **20**: 9. *pl. 2.* 1870.